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humming-birds and swifts, and some of the best flyers among parrots have an imperfect clavicle.

Chapter three deals with motive power, leverage, propulsion, wing stroke and the manner in which the wings attack the air, a manner well described on page 45.

Here, too, a query. Mr. Headley thinks that the kestrel can not hover unless the wind is blowing against him. We believe that the kingfisher *can* do this, and the humming-bird and hawk moth will hover above a flower and circle around it with no apparent difficulty. Mr. Headley points out that quality of muscle is quite as important as quantity, and notes that while ordinarily the elevator muscles are inferior to the depressor, in the guillemot, a swimming bird, they are on a parity. Undoubtedly his explanation is correct; the bird that uses its wings to fly beneath the water needs powerful muscles to raise them. This is in line with the deeply keeled sternum and abundant muscles of the penguin and great auk, birds incapable of aerial flight, that wing their way swiftly beneath the water.

Further chapters deal with the relation between the form of wings and mode of flight, speed and endurance and the influence of the wind. Here we find repeated the theory that soaring (circling upward) is made possible by upward currents of wind, a theory that we think few will find satisfactory. A bird may circle about in such a current, but it would not have strength enough to raise him and we feel that the most that can be said is that in some way, as yet beyond our power of imitation, birds, so to speak, screw themselves through the air to vast heights, over the level pampas as well as over the gusty mountain tops.

But one can not indulge in much discussion in little more than 150 pages and the average reader will prefer to have the facts rather than theories: and Mr. Headley has done well to give us so many facts and so much well-told information in so small a compass.

A feature of the book are the illustrations of birds, mainly pigeons, and for the most part from Mr. Headley's photographs, in

various phases of flight. These give an idea of the varied poses of the wings and tail, and their relation to the balance of the bird, or direction of its flight, that can not be gained from words.

F. A. L.

#### SPECIAL ARTICLES

##### THE EVENING PRIMROSES OF DIXIE LANDING, ALABAMA

BARTRAM's locality for *Oenothera grandiflora* at Dixie Landing on the Alabama River some distance above Fort Mimms (1778) was rediscovered by Professor S. M. Tracy in 1904 and visited a second time by him in 1907. Seeds procured by Tracy have been widely distributed and have given rise to races of *Oenothera grandiflora* which are being studied by several investigators.

*Oenothera grandiflora* is one of the nearest allies of *O. Lamarckiana* and seems to agree with that species in at least some points pertaining to mutability and behavior on hybridizing. Its study may at some time lead to an explanation of those phenomena which until a short time ago seemed peculiar to *O. Lamarckiana*. Consequently it seemed to us to be of primary importance to study *O. grandiflora* in its original habitat, and we visited Dixie Landing under the kind guidance of Professor Tracy, on September 26 and 27.

It had been known from cultures grown by Professor B. M. Davis from Professor Tracy's wild seed that *O. grandiflora* did not occur at Dixie Landing as a single pure strain. It was no surprise, therefore, to find growing in the old cotton fields several forms of *O. grandiflora*, together with several forms of its companion species *O. Tracyi*, which has recently been described by one of us. The plants were partly in flower and partly in the rosette condition. Neither *O. grandiflora* nor *O. Tracyi* has heretofore been known as other than annual, and the abundance of rosettes which would obviously not flower this season was therefore a point of great interest. Seeds were obtained from all strains which had ripe capsules, and in addition a large collection of

rosettes was sent to Washington to be grown there.

The evening primroses are found all along the river bluffs, often at the very edge of the perpendicular bank, which is some twenty feet higher than the river. In the old cotton fields they evidently find a favorable habitat, as may be concluded from their abundance in even very recently cultivated fields. The two species, *Oenothera grandiflora* and *O. Tracyi* were found growing together in all the fields which we studied, including those from which Professor Tracy's seed had been obtained in former years. Really pure stands of *O. grandiflora* we failed to find either in the old fields or in the woods along the river. Intermingled with the most frequent types of *O. grandiflora* and *O. Tracyi* were numerous less abundant types. This was particularly true in the old fields. It is hardly probable that all of the types which occur at Dixie Landing were observed by us. The following types, designated by letters from *a* to *l*, were noted, and of some of them seeds were obtained. Of other types, which were just coming into flower, seeds could not be obtained, but it is hoped that these will be found in the collection of rosettes which was sent to Washington.

1. Types like *O. grandiflora*, *i. e.*, types having large flowers with the style longer than the stamens: (*a*) with green, glabrous calyx segments and short capsules; (*b*) with green, viscid-puberulent calyx segments and short capsules; (*c*) with red-spotted, glabrous calyx segments and short fruit; (*d*) with red, glabrous calyx segments and long capsules; (*e*) with red-spotted, viscid puberulent calyx segments and short capsules; (*f*) with red-spotted glabrous calyx segments and petals orange-colored on wilting (all the other types were light yellow on wilting); (*g*) with red-spotted, glabrous calyx segments and pinnatifid leaves (all the other types had the leaves merely dentate or subdentate).

2. Types like *O. Tracyi*, *i. e.*, with flowers medium sized and stamens reaching the stigmas: (*h*) with green calyx segments and green, pilose capsules; (*i*) with green calyx

segments and green, glabrous capsules; (*j*) with red-spotted calyx segments and green, pilose capsules; (*k*) with red-spotted calyx segments and pilose, longitudinally red-striped capsules; (*l*) with red calyx segments and green capsules, a beautiful form the coloration of which suggests that it may be a variant of *O. Tracyi* parallel to certain of the Amsterdam mutants of *O. Lamarckiana*.

The classification of the types of *O. grandiflora* does not take into consideration the pubescence of the stem, which varies widely, the shape of the leaves, which is equally variable, or the mode of branching, which can not be accurately judged in specimens growing under the diverse conditions afforded by the habitat at Dixie Landing. It should be noted that all of the *Oenothera grandiflora* types had glabrous, green capsules, that none of them were at all ambiguous with respect to the size and position of the floral parts, and that none of them could be considered at all similar to the *O. Lamarckiana* of the Amsterdam cultures. A very few specimens were found of which the broad leaves were somewhat crinkled, but so slightly so as to suggest that the variation was merely individual or accidental.

The classification of the types of *O. Tracyi* takes no account of the width of the leaves, or of the degree and kind of pubescence. Of course a more complete analysis of the composition of the *Oenothera* population at Dixie Landing will be made when the rosettes have flowered in Washington and a second generation has been grown from self-pollinated seed of all the forms found in the collection. At the present time it is sufficient to point out that no *Oenothera* from Dixie Landing, however constant it may seem to be when grown generation after generation from self-pollinated seed, can be cleared of the suspicion that it may be of hybrid origin. In other words, the same suspicion that attaches to so many of the strains of *Oenothera Lamarckiana* in Europe attaches to any strain of *Oenothera grandiflora* which is now being used by experimenters.

It is therefore of some importance to compare the conditions under which *O. grandiflora*

*flora* grows at Dixie Landing with the conditions under which *Æ. Lamarckiana* occurs at its European stations. The race of *Æ. Lamarckiana* which occurs at Hilversum is unmixed, since no other species of *Enothera* grows at that locality. Of its mutants only *Æ. laeviflora* and *Æ. brevistylis* have been observed to flower regularly in the field: the other forms either do not flower at all or only so rarely as to have hardly any influence on the purity of the strain. In the sand dunes of Holland, on the contrary, *Æ. Lamarckiana* is mixed, as a rule, with European *Æ. biennis* and is observed to produce the three different hybrids which are obtained when these two species are artificially hybridized. The same statement holds good for many localities where the two species grow in France and England. Every individual from such a station, however closely its external characters may seem to coincide with those of one of the parent species, must always lie open to the suspicion of having had a hybrid ancestry.

In connection with the fact that the Dixie Landing types are so sharply divisible into two groups, it is permissible to suggest that they may correspond in a general way with hybrids between *Æ. Lamarckiana* and *Æ. biennis* "Chicago" which have already been studied. From the cross *Æ. Lamarckiana* × *Æ. biennis* "Chicago" and its reciprocal, two pairs of twin hybrids were obtained at Amsterdam in the first generation, viz., *Æ. læta* and *Æ. velutina*, and *Æ. densa* and *Æ. laxa*. The first pair of twins, from the cross *Æ. Lamarckiana* × *Æ. biennis* "Chicago," has already been described, the other pair, from the reciprocal cross, will soon be published in another paper. Possibly one group of the Dixie Landing types is related to *Æ. grandiflora* in the same way that *Æ. densa* and *Æ. læta* are related to *Æ. Lamarckiana*, and the other group to *Æ. Tracyi* as *Æ. laxa* and *Æ. velutina* are related to *Æ. biennis* "Chicago." Of course the situation at Dixie Landing is probably complicated by the recrossing of the hybrids with themselves and with their parents. However that may prove to be, the Dixie Landing types are now available for

study and it is hoped that future work may show in what manner they are related. At the present time no conclusion regarding them is justified other than that they constitute so mixed a population that it is quite impossible to distinguish original parent types, if any such exist there, from the derivative types associated with them. In case the two most common types represent the original strains, the presence in other types of characters which are not common to either hypothetical parent suggests that *Æ. grandiflora* and *Æ. Tracyi* may prove to be additions to the list of species, including *Æ. Lamarckiana*, *Æ. cruciata* "Adirondack," European *Æ. biennis*, and *Æ. biennis* "Chicago," which are known to be in a mutable condition.

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#### THE GREAT CRESTED GREBE AND THE IDEA OF SECONDARY SEXUAL CHARACTERS

CERTAIN facts in the structure and habits of this bird (*Podiceps cristatus* L.) have such a general bearing upon the whole conception of secondary sexual characters that it seems desirable to publish them here. The facts are these: the great crested grebe possesses an erectile ruff at the sides of the neck and a pair of erectile tufts on the head. The male is slightly larger in total size, and his ruff and tufts are also slightly larger, relatively as well as absolutely; otherwise the sexes are identical. The ruff and tufts are used extensively in courtship; at other times they are only occasionally erected, and then never to their full extent. The courtship-actions, including all the movements of ruff and tufts, are identical in the two sexes. The ruff and tufts and the actions in which they are concerned would be called secondary sexual characters, were they not common to both sexes, for secondary sexual characters are always defined with regard to this very point, their difference in the two sexes. I take a random